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FOR MANAGEMENT IN ELECTRONICS, COMPUTER, AND SYST

APRIL 8, 1991

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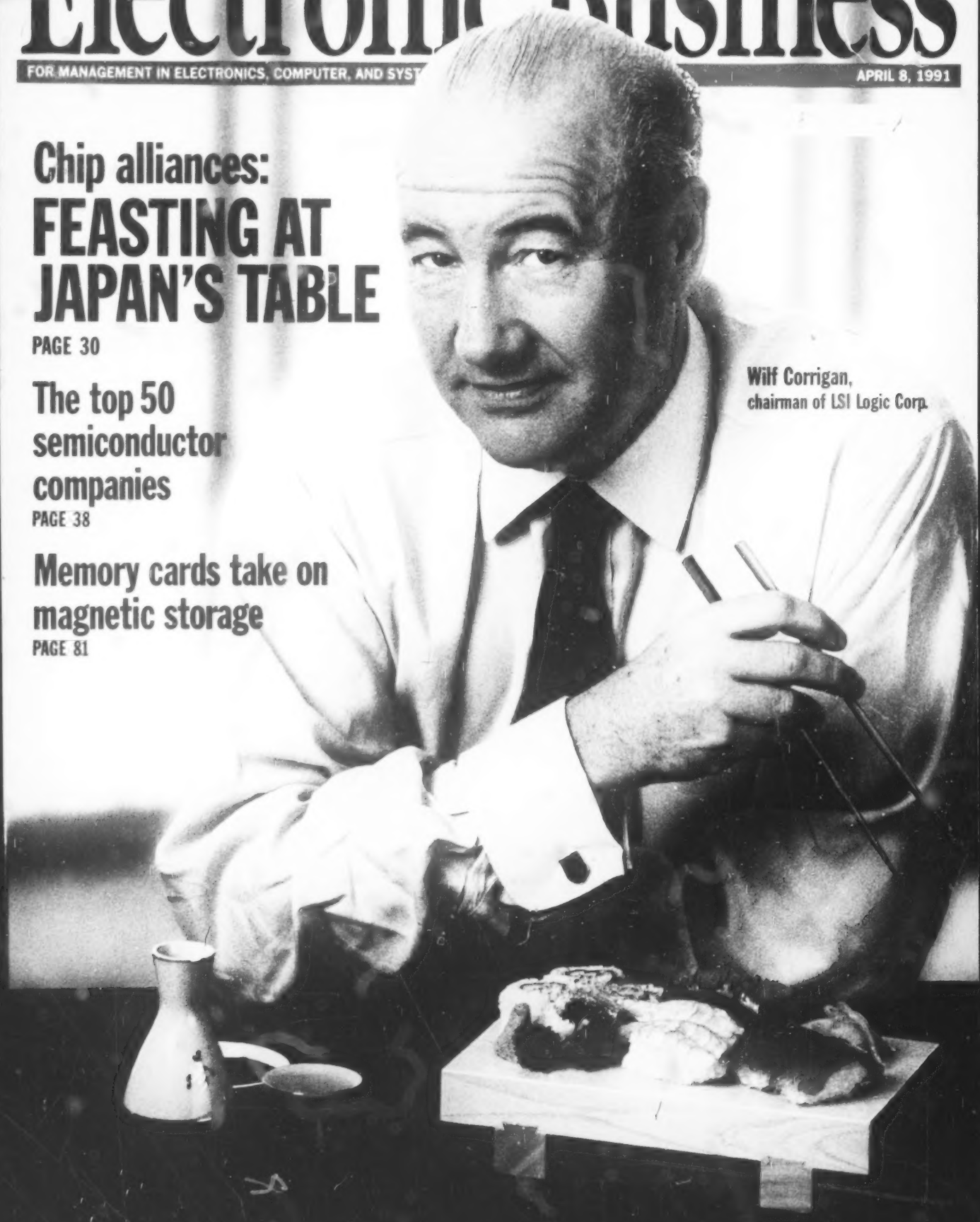

Wilf Corrigan, chairman of LSI Logic Corp.

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES—WORLDWIDE

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The price of being a serious player in the world semiconductor market has gotten out of hand. For many U.S. chip companies, the only alternative is to find a deep-pockets partner, either at home or abroad. But some experts make the case that, since U.S. companies are so ill-suited for partnering, they often give far more than they get

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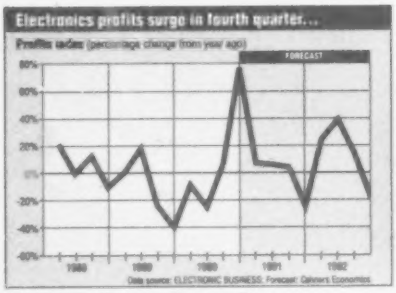

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(303) 388-4511

Total Circulation: 77,804

REPRINTS

ELECTRONIC BUSINESS articles are available on a custom printing basis at reasonable prices. Contact Andrea Marwitz, Cahners Reprint Service, Cahners Plaza, 1350 E. Touhy Ave., P.O. Box 5080, Des Plaines, IL 60018 (708) 635-8800
Electronic Business can be purchased on 35mm microfilm through University Microfilm Int. Periodical Entry Dept., 300 Zeeb Road, Ann Arbor, MI 48106

What's your technology worth?

Remember the Old Testament account of the two women who both claimed to be the mother of a certain child? According to the story, King Solomon settled the dispute by ordering that the infant be cut in half and divided between the two women. He reasoned—rightly, as it turned out—that only the real mother would give up her claim rather than see the child destroyed.

Contributing editor Valerie Rice: Are partnerships good for U.S. companies?

For today's small U.S. technology company, that story has a familiar ring. Every year, untold numbers of entrepreneurs must choose between turning their precious, hard-won expertise over to strangers—usually large Japanese companies—and allowing the technology to die aborning for lack of funds.

The dilemma is by no means a new one. But we are no closer to a solution now than we were a decade ago, when Wilf Corrigan traded his know-how for financing via a Japanese partnership. Was it a good swap? Corrigan thinks so, since it was the only way that his semiconductor company—LSI Logic Corp.—could get off the boards. But as contributing editor Valerie Rice writes in "Why teaming up is so hard to do," others are more skeptical. Some say that such partnerships are at best ineffective; at worst, they arise from a fundamental weakness within the U.S. electronics industry and in effect do little more than bolster the technological arsenal of our toughest technological competitors.

In this case, the answer almost certainly lies somewhere between these two extremes. But one also must wonder if anyone is even arguing about the real issue. Perhaps the point of contention is not whether U.S. companies are striking good deals with their Japanese partners (some are, some aren't), but why they're being forced to take up partnerships in the first place.

We've heard most of the stock answers: impatient investors, the high cost of capital, and the lack of an industrial policy (what *is* industrial policy, anyway?) in Washington that supposedly puts U.S. electronics at a severe disadvantage vis-a-vis Japan and Western Europe. But Rice notes an even more damning reason: U.S. companies are notoriously poor students who are often more intent on parading their R&D than in learning how to manufacture efficiently. If she's right, we'd better get used to the idea that we are doomed to be forever choosing between technological infanticide and selling our offspring to the highest bidder.

This time, even Solomon's wisdom might not be able to help.

H. GARRETT DeYOUNG, managing editor

ELECTRONIC BUSINESS® (ISSN 0163-6197, GST Reg. #123397457) is published twice a month, except monthly in December, by The Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington Street, Newton, MA 02158-1630. Terrence M. McDermott, President; Frank Sibley, Executive Vice President; Jerry D. Neth, Senior Vice President/Publishing Operations; J.J. Walsh, Senior Vice President/Finance; Thomas J. Dellamaria, Senior Vice President/Production and Manufacturing; Ralph Knupp, Vice President/Human Resources. ELECTRONIC BUSINESS® is a registered trademark of Reed Properties Inc., used under license. Circulation records are maintained at Cahners Publishing Company, 44 Cook Street, Denver, CO 80206-5800. Telephone: (303)388-4511. Second-class postage paid at Denver, CO 80206-5800 and additional mailing offices. **POSTMASTER:** Send address corrections to ELECTRONIC BUSINESS®, PO Box 173377, Denver, CO 80217-3377. ELECTRONIC BUSINESS® copyright 1991 by Reed Publishing USA; Ronald G. Segel, Chairman and Chief Executive Officer; Robert L. Krakoff, President and Chief Operating Officer; William M. Platt, Senior Vice President. Annual subscription rates for non-qualified people: USA, $79.95; Canada, C $99.95; other countries, $120 per year; $100, air mail surcharge. Except for special issues where price changes are indicated, single copies of regular issues are available for $10.00 (USA, Canada/Mexico and foreign). Please address all subscription mail to Eric Schmierer, 44 Cook Street, Denver, CO 80206-5800. Cahners Publishing Company, A Division of Reed Publishing USA • Specialized Business Magazines for Building & Construction • Research • Technology • Electronics • Computing • Printing • Publishing • Health Care • Foodservice • Packaging • Environmental Engineering • Manufacturing • Entertainment • Home Furnishings • Interior Design. Specialized Consumer Magazines for Child Care • Boating • Wedding Planning

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nouncements from DEC and HP, endorsements have been received from Unisys Corp., Oki Electric Industry Co., DuPont Co., ITT, and a smattering of smaller bus component vendors. Still, the best guesses of industry observers are that Futurebus+, in whatever form it takes, will not be around as a working bus for at least another two years. The question is, if VME and Multibus II still provide adequate performance for a fraction of the cost, will anyone care?

DAVE WEBB

IPOs

Venture capitalists take stake in software

IF 1990 PERFORMANCE is any gauge, electronics, computers, and software still rank highly with the venture-capital industry. While last year's IPOs didn't keep the venture crowd as busy as they would have liked, the electronics industry at least kept the money moving.

Of the 42 companies that went public last year, 12 were computer-related—9 in software and services and 3 in hardware and systems, according to Venture Economics Inc. of Needham, Mass.

That continues a trend among investors that began five years ago. Between 1986 and 1990, electronics-related companies accounted for 45% of all IPOs. The number was 46% in 1989 and reached 50% last year.

Tempering that trend is the fact that for all industries, total venture-capital disbursements during the first half of 1990 plummeted 47% compared with the first half of 1989. One reason that electronics fared so well among IPOs in 1990: Software hit it big. Total capital provided by the venture community to software companies grew 2% in the first half of 1990 compared with the first six months of 1989. As a result, new offerings by nine computer software and services companies last year reached $236 million, compared with just four IPOs worth $84 million during 1989. In fact, software was the only industry to see an increase in total venture capital disbursements, says *Venture Capital Journal* editor John Bonnanzio.

Still, last year's stock market provided plenty of white-knuckle flying for venture capitalists. From the date of the stocks' IPO to Dec. 31, 1990, the composite price of the 42 new venture-backed issues slid 8% during the year. The best performers, however, beat the trend with an average stock price increase of 25% by concentrating on such fundamentals as low debt and attractive P/E ratios. The worst stock price slides—those with a decline of more than 40% between their IPO and year-end—hit five communications companies, a software company, and a producer of simulation systems used to design integrated circuits.

ELIZABETH B. BAATZ

The best and worst IPOs

(percentage change in stock price from date of IPO to Dec. 31, 1990)

Company	IPO date	Business	% change
The best:			
Cisco Systems Inc.	2/90	LAN interconnect	149.3
Marcam Corp.	8/90	CIM software	78.6
Micrografx Inc.	6/90	graphics software	59.4
Easel Corp.	8/90	software tools	43.8
Xilinx Inc.	6/90	gate arrays	37.5
RasterOps Corp.	5/90	graphics systems	31.3
Integrated Systems Inc.	3/90	CAE/CASE software	30.6
Alias Research Inc.	7/90	design software	25.0
The worst:			
Digital Sound Corp.	2/90	phone message systems	-82.4
IKOS Systems Inc.	7/90	electronic design	-66.3
Syntellect Inc.	3/90	voice response systems	-53.3
Telebit Corp.	4/90	modems	-51.3
Aspect Telecommunications	5/90	telephone systems	-50.0
MECA Software Inc.	7/90	PC software	-45.0
Sequoia Systems Inc.	7/90	computer systems	-44.7

Source: Venture Economics Inc.

HIGH-TECH

Zenith unveils a big-time bodyguard

WHEN NYCOR INC., an investment company set up by air conditioner-maker Fedders Corp. of Peapack, N.J., launched a proxy fight against the management of Zenith Electronics Corp. on Jan. 10, there was a distinct possibility that America's best hope to play in the hig. -tech TV business of the future would fall into the hands of low-tech appliance manufacturers. After all, Zenith—the last U.S.-owned manufacturer of color TVs—had lost $169 million since 1985, had dumped its profitable computer business in 1989 to stem a flood of debt, and had overseen the fall of its stock price from $30 in mid-1988 to around $7 in early 1991. So Nycor's claim that Zenith lacked a coherent strategy for recovery was bound to strike a chord with some investors.

But with stockholders set to vote on the subject on Apr. 24, Zenith got some heavyweight help from an unlikely source—Goldstar Co., the $5 billion subsidiary of $30 billion behemoth Lucky-Goldstar Group of Seoul, South Korea. Not only did Goldstar agree to buy 4.97% of newly issued Zenith stock—at a 50% premium over the going market rate—but the company also inked two technology agreements bringing Glenview, Ill.-based Zenith's long-term strategy into much clearer focus.

The first deal gives Goldstar license to make and sell Zenith's patented "flat tension mask" displays, a CRT-like assembly that features a flat, rather than curved, viewing surface resulting in heightened contrast and reduced glare. Licensing fees alone will be "in the multimillions" of dollars, says Zenith's John Taylor.

The second agreement is a ringing endorsement of Zenith's high-

Inside the top 50 worldwide chip companies

Who's on top? Japan, of course. But there's a lot more than meets the eye behind the top 50 semiconductor company ranking for 1990

BY ELIZABETH B. BAATZ AND LINDA STALLMANN

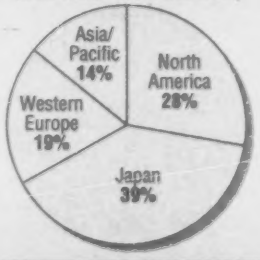
There are no surprises on our 1990 ranking of semiconductor companies: As far as merchant integrated circuit manufacturing is concerned, the top three companies hold precisely the same spot they had in last year's list. Japan's NEC Corp. is ranked the number-one company with Toshiba Corp. in the number-two slot and Hitachi Ltd. as number three. According to the leading semiconductor list makers—Integrated Circuit Engineering, Dataquest, and In-Stat—Japan's dominance at the top of the largest semiconductor company lists is a well-known fact. This year, with the help of ICE, ELECTRONIC BUSINESS has delved deeper into the semiconductor list, and the facts that lurk behind the "who's on top" headline are revealing.

Japanese semiconductor companies make more ICs in the merchant market than any other nation. In 1989, 17 Japanese companies accounted for 54% of all merchant IC sales, according to our list, a fact that is astonishing and to some a frightening testimonial to the preeminence of Japan's semiconductors. But even Japan's powerhouse semiconductor makers saw their share of worldwide sales fall in 1990 to 52%.

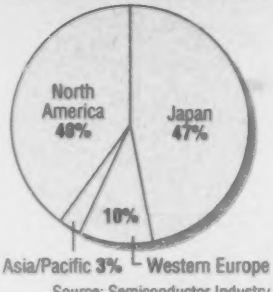
Last year was not a great year for Japan's semiconductor industry. Manufacturers—who have relied too heavily on dynamic random access memory chips—could not stem the bleeding as DRAM prices plummeted. Also Japan's export growth slowed, and domestic demand didn't make up the difference entirely. As a result, IC sales by the top Japanese manufacturers rose just 3% last year. (Measured in U.S. dollars, their sales fell 2% as the value of the yen weakened.) Number-one NEC managed to buck this trend by growing merchant sales 5.5% in yen last year.

Where semiconductors are consumed...

(percentage share in 1990 $50.5 billion worldwide sa...)



...and who sells the chips



Source: Semiconductor Industry Association, preliminary estimates

In the face of Japan's market share stranglehold, is there hope for U.S. semiconductor companies? The top 50 list suggests there may be more hope than the nation's doomsayers suggest. Twenty-two U.S.-owned semiconductor companies made it onto the top 50 list in 1990. They accounted for 35% of the top 50's total sales, up from 34% the year before. And while Japanese sales were taking a hit from falling memory chip prices, the top 10 U.S. companies managed an overall 9% gain despite a slump in military IC demand. Strength in the microprocessor market ensured above-average sales growth for the two leading U.S. companies, Intel Corp. and Motorola Inc.

According to San Jose consulting company, VLSI Research Inc., another positive trend—the emergence of mixed-signal ICs—bodes well for the U.S. companies' future. VLSI Research president G. Dan Hutcheson says mixed-signal ICs will be to the '90s what application-specific ICs were to the '80s and microprocessors and memory chips were to the '70s. (Hutcheson defines mixed-signal devices as those in which both analog and digital functions are built onto the same chip in any proportion.) The five leading mixed-signal IC suppliers in the world now are U.S.-owned companies, and these five also have sizable mixed-signal export sales to Japan. NEC doesn't enter the top 10 mixed signal-IC list until position number 7, says Hutcheson.

Across the Atlantic Ocean, six European companies made it onto the top 50 list, although the first on the list, Philips/Signetics, didn't reveal itself until position number 12, and SGS/Thomson/Inmos stood at number 13. Sales of Europe's six leading IC makers, when measured in U.S. dollars, garnered the multinational team 9% of total sales of the top 50, up from an 8% share the year before.

The two largest European semiconductor companies accounted for nearly 60% of all merchant IC sales made by European-based companies. This trend toward consolidation, with the prospect of one single European market looming in 1992, will no doubt continue among European companies during the next decade. Compared with Europe, the concentration of semiconductor sales in the top two companies is much lower in both the United States and Japan—with the two largest U.S. companies accounting for just 36% of all U.S.

sales and the top two in Japan accounting for 33%.

The newcomers to the top 50 semiconductor maker rankings are the Asian Pacific companies. In 10th place, South Korea's Samsung Electronics Co. ranked highest among its compatriots and Pacific neighbors. Two more South Korean and two Taiwanese companies round out the list. Together the Asian Pacific companies account for the final 4% of the $45 billion in sales by the top 50 largest merchant semiconductor companies.

In the '90s these regional distinctions will become more and more important to the governments and perhaps less and less important to the large chip companies of the world. As Japan looks for partners and purchases in the United States and Europe, U.S. companies will ally with partners in the Pacific and across the Atlantic. Who's on top? Depending on who owns what, where the chip is made, and who licenses the technology, the answer will become increasingly shrouded in the multinational fog every year. □

Definitions:

Companies are ranked by IC sales only (does not include discrete semiconductors).

Merchant semiconductor sales do not include U.S. captive (e.g. IBM, DEC, etc.) production.

All figures that describe "sales by geographical headquarters location" include all sales by a company regardless of where the product is produced or sold. All of Texas Instruments' semiconductor sales, including those from its Japanese and European facilities, for example, are listed under North American semiconductor sales.

Percentage change figures were calculated from sales data as measured in the local currency where the companies' headquarters are located. For example, the Japanese and Asian Pacific currencies weakened against the dollar from 1989 to 1990. As a result, the percentage change figures are higher in the local currency than they would have been if translated into U.S. dollars. The European currencies strengthened against the dollar, so the reverse is true.

Top 50 semiconductor companies

Rank	Company	1990 Sales ($ million)	% change* 1990/1989	Location
1	NEC	$4,145	5.5%	Japan
2	Toshiba	3,570	1.4%	Japan
3	Hitachi	3,205	2.7%	Japan
4	Intel	2,915	20.0%	N. America
5	Fujitsu	2,765	-0.7%	Japan
6	Motorola	2,750	9.3%	N. America
7	Texas Instruments	2,715	0.0%	N. America
8	Mitsubishi	2,035	-0.1%	Japan
9	National Semiconductor	1,611	6.0%	N. America
10	Samsung	1,335	13.4%	Asia/Pacific
11	Matsushita	1,285	11.6%	Japan
12	Philips/Signetics	1,175	-14.2%	Europe
13	SGS/Thomson/Inmos	1,175	-1.1%	Europe
14	OKI Semiconductor	1,100	2.3%	Japan
15	Advanced Micro Devices	1,050	-2.8%	N. America
16	Siemens	1,000	2.0%	Europe
17	Sharp	975	1.4%	Japan
18	Sanyo	955	2.4%	Japan
19	Rohm	780	7.8%	Japan
20	AT&T	725	1.4%	N. America
21	Sony	720	3.6%	Japan
22	Harris	655	-5.8%	N. America
23	Western Digital	575	19.3%	N. America
24	LSI Logic	540	18.9%	N. America
25	Seiko Epson	535	10.2%	Japan
26	Fuji Electric	400	5.1%	Japan
27	Analog Devices [1]	366	35.6%	N. America
28	VLSI Technology	300	15.4%	N. America
29	Micron Technology	295	-6.3%	N. America
30	GEC Plessey	270	7.8%	Europe
31	Hyundai	250	1.3%	Asia/Pacific
32	Cypress Semiconductor	235	18.1%	N. America
33	HMB Semiconductor	220	-5.6%	Japan
34	ITT	210	-10.3%	Europe
35	Integrated Device Technology	200	-2.4%	N. America
36	United Microelectronics	180	41.1%	Asia/Pacific
37	New Japan Radio	180	8.1%	Japan
38	Yamaha	175	8.2%	Japan
39	Silicon Systems [2]	170	36.0%	N. America
40	Ricoh	170	2.1%	Japan
41	Burr-Brown	145	6.6%	N. America
42	Goldstar	141	21.8%	Asia/Pacific
43	NCR	125	4.2%	N. America
44	Atmel	125	23.8%	N. America
45	Telefunken	120	-13.3%	Europe
46	Allegro [3]	116	NA	N. America
47	Gould AMI	115	-4.2%	N. America
48	Zilog	105	9.4%	N. America
49	Dallas Semiconductor	100	22.0%	N. America
50	Taiwan Semiconductor	100	32.3%	Asia/Pacific
	Total	$45,104	3.1%	

1 Includes Precision Monolithics for 1990
2 Purchased in 1989 by TDK
3 Formerly Sprague Semiconductor, owned by Sanken Electric

NA = Not available
* in local currency
Source: ICE Corp.

Taiwan's PC makers at the workstation crossroads

Five Taiwanese companies are in the market now, and others are poised to join them. But the field may be too crowded

BY RUSS ARENSMAN

Stroll through the showroom at the Tatung Co. headquarters in downtown Taipei and you'll see relatively few high-tech products. There is an area devoted to PCs, but most of the showroom is filled with refrigerators, ovens, and electric fans.

Tatung's merchandise illustrates its predicament—the company owes its position as Taiwan's largest electronics company more to older technologies like electric motors and compressors than to expertise with emerging technologies like semiconductors and computers. Moreover, their profit margins have been squeezed even further in recent years by the appreciation of the new Taiwan dollar. For Tatung, the net result is that, after years of steady growth, the company's sales flattened in 1990 at $2.1 billion, virtually the same as the previous year's.

Company officials hope to revive Tatung's growth by focusing on the technology-intensive—and potentially more profitable—electronics market. Tatung already has become Taiwan's largest PC monitor manufacturer, and its sales of PCs and computer-related equipment have increased from virtually nothing a decade ago to about one-third of its current revenue.

But even the PC market is becoming difficult, concedes Tatung president W. S. Lin, especially at the low end. As a result, the company has set its sights on the logical next step in its product evolution: workstations.

Tatung certainly isn't the only Taiwanese company interested in workstations. Four other of the island's electronics companies—Sampo Technology Corp., Datatech Enterprises Co., Chicony Electronics Co., and Twinhead International Corp.—plan to enter the market, and several others are considering the move. Sampo is part of a large manufacturing group that, like Tatung, is trying to move beyond appliances into more sophisticated electronic products. The other three are smaller, younger companies that started building video games and PC products during the past decade.

Despite their differences, all of them see workstations as an opportunity to diversify and gain a foothold in a young, fast-growing market. Tatung, however, appears to be making the biggest commitment to the workstation market and, to date, has made the fastest progress in developing a product line. Nearly two years ago Tatung engineers in Taiwan and California started developing workstation designs from Sun Microsystems Inc.'s scalable-processor architecture (Sparc) technology. By last August they were ready to announce the first Taiwan-made Sparc workstation, called the Mariner 4i.

Tatung's president W. S. Lin is setting his sights on the next logical step: workstations

Lin, whose grandfather founded Tatung as a construction company in 1918, expects workstations to become one of the company's biggest growth areas in coming years and estimates the company will sell 6,000 units in 1991.

According to Dataquest Inc., workstations represent the computer industry's fastest-growing market segment. The San Jose research firm forecasts worldwide workstation sales revenues will grow by more than 20% a year through the mid-1990s,

from $7.4 billion in 1990 to $20 billion in 1994. Most of the computer industry's major players—including Hewlett-Packard Co. and Digital Equipment Corp.—are trying to take business away from the market leader, Sun Microsystems, which claimed nearly one-third of all workstation shipments and revenue during 1990.

Recently the market began to attract a crowd of new contenders. At last count, analysts expected at least 30 companies, many of them from Taiwan and Korea, to enter the workstation market in the next year. Most of the Asian companies hope to repeat strategies that fueled the phenomenal growth of the Taiwanese PC industry during the 1980s—this time building clone workstations. And instead of Intel microprocessors and MS-DOS software, most of the workstation clone makers plan to license Sun's Sparc microprocessors and its proprietary Unix operating system, which will allow their machines to use the roughly 2,800 software applications already developed for the Sparc market.

Sampo's Martin Wu says the company plans to develop more powerful models before year's end

Most analysts don't expect the clone makers to make a big dent in the market initially. Workstations require a different sales strategy and distribution channel than PCs. While PC buyers are usually content to buy machines from retail outlets, most workstation buyers expect more support in areas like setting up their system and training employees.

David Hoffman, a research analyst for the Taiwanese consulting firm Investec (Taiwan) Ltd., says the biggest challenge for Taiwan's workstation clone makers will be marketing. "The companies here develop good products," he says. "But can they market them?" Hoffman doubts any of the current Taiwanese workstation makers know enough about workstations or international marketing to succeed in such a competitive business.

The optimists guess that perhaps 30,000 Sparc-compatible clone machines will be sold this year. But in a few years, the impact could be more substantial. Fujitsu Microelectronics Inc., which hopes to sell Sparc chip sets to many of the clone makers, projects that by the end of 1993, Sun-compatible clones will comprise 16% of the worldwide technical workstation market, generating $2.9 billion in revenue.

Sun has been licensing its Sparc technology since 1987. But licensing and royalty fees were expensive, and

What counts is not making the workstations but selling them

until recently licensees had to figure out how to build many of their own Sparc chips. Last year, however, Sun decided to encourage clone makers by allowing its semiconductor suppliers—including Fujitsu, LSI Logic Corp., and Cypress Semiconductor Corp.—to sell complete Sparc-compatible chip sets.

"Until then nobody wanted to pay Sun $2 million, and nobody had the 50 engineers and two-year lead time to develop their own solution," says Ron Jankov, the former general manager of LSI Logic's sales office in Taiwan.

Thanks to the chip set vendors, Sparc clone makers finally arrived in force at last November's U.S. Comdex computer show. About a dozen companies, including all five of the Taiwanese clone makers, announced workstations based on LSI Logic's 20 megahertz Sparc chip set.

LSI Logic won orders from most of the early clone makers by helping them enter the market quickly with a start-up kit that includes a compete circuit board design and all the software needed to build workstations compatible with Sun's SparcStation 1 machines.

But observers doubt that there will ever be a large market for 20 MHz machines based around the LSI Logic chip set—too many companies have signed up to make essentially the same product, which lost much of its appeal last summer when Sun introduced its more powerful 40 MHz SparcStation 2 line.

But for many clone makers, the LSI Logic chip set was the best way to get an early start. "In the beginning I didn't have much choice but to use the 20 MHz products," according to Martin Wu, marketing director for Sampo. "Sampo needed something to just get started with." The market for the initial 20 MHz machines may turn out to be relatively small, he concedes, but Sampo plans to develop more powerful models before year's end.

Archie Yeh, a researcher with the Taiwanese government's Computer & Communications Research Laboratories (CCL), says he is worried that so many of the Taiwanese clone makers are building similar machines. "You will see a very crowded market, which will drive profit margins down very fast," warns Yeh.

Although Sun has encouraged clone makers to license its Sparc technology, Sun isn't an easy target for clone makers to compete against, says Justin Tsay, workstation marketing manager for Twinhead. "Sun is pricing very aggressively in the low-end market," he says. Twinhead and other clone makers initially hoped to win over Sun customers by pricing

their workstations 20% or 30% beneath Sun's equivalent models. But to date, Sun's relentless price cutting has made it difficult for clone companies to even match its prices.

As a result, Twinhead has yet to decide whether to put a workstation based on LSI Logic's 20 MHz chip set into production—even though it has licensed the technology.

Adding unique features and capabilities is one of the best ways for clone makers to take advantage of profitable niche markets while avoiding the brutal price competition of the commodity workstation areas. Most of Taiwan's companies appear to be taking steps in that direction. Datatech, for example, has developed a 25 MHz workstation based on Cypress Semiconductor chips that is currently the only Taiwanese-made clone to use a Motorola-type VME system bus instead of the usual Sun S-bus to handle expansion and enhancement products.

Another differentiation strategy comes from Tatung, whose Mariner 4i workstation offers an optional DOS coprocessor board. The board is equipped with an Intel 25 MHz 80386 microprocessor, VGA graphics capability, and cache memory, allowing users to operate IBM-compatible DOS software without leaving the Unix window environment or compromising the performance of the PC software. Tatung officials say 80% of the early Mariner systems shipped have been equipped with the DOS coprocessor.

Both Tatung and Datatech hope to begin production by 1992 of another workstation design developed jointly with CCL. They are the only two surviving members of a workstation consortium started by CCL in early 1989 for the purpose of making Taiwan a major force in the workstation industry. Four other Taiwanese electronics companies—including the country's largest PC maker, Acer Inc.—were originally invited to join the consortium. But Acer, Copam Electronic Corp., and two smaller companies quickly dropped out of the project after PC industry giants Intel Corp. and Microsoft Corp. pressured them to stay away from the Sparc clone business.

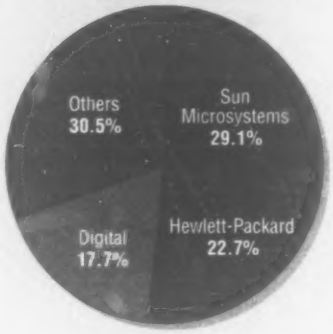
Microsoft president Bill Gates and Intel vice president Albert Yu flew to Taiwan to lobby companies against joining the Sparc consortium, which suggests how threatening the idea may have been to the U.S. companies: The last thing Intel and Microsoft wanted to see were their largest customers defecting to the Sparc camp.

CCL officials say that before Intel and Microsoft exerted influence, Acer was the most enthusiastic member of the workstation consortium. Despite its withdrawal from the workstation business, many in the industry wonder how much longer Acer will be willing to stay out. CCL official Yeh notes that virtually all of the major Korean PC makers have announced plans to expand into workstations and have aligned themselves with either Sun or another major workstation vendor.

Acer vice president Kwan G. Tan, who left Sun two years ago to spearhead Acer's workstation development effort, says that Acer officials are still weighing whether it makes sense to enter the workstation market. "We are interested, but we're still investigating what sort of workstation we should break into," he says.

Coveting a piece of Sun's market share

1990 worldwide workstation market
factory revenue= $7.4 billion



Source: Dataquest Inc.

Workstation sales growth will top 20% a year through 1994

Tan worries that too many Asian companies are moving into the Sparc-clone business. "We are concerned that there isn't much room for the clone maker to make a profit, especially when Sun's price is coming down continuously," he says.

Tan, who helped develop the first Sparc workstation and chip set when he worked at Sun in the mid-1980s, says Acer will have no trouble developing a product line in a hurry if it decides to enter the market. "It's not making the workstations per se, it's how you sell them," he remarks. "This is really a channel/distribution problem. Any company that doesn't solve that problem won't make money."

"Acer is the only company that will do it, and I think they took the right approach by buying Altos," says Investec's Hoffman, referring to Acer's 1990 purchase of Altos Computer Systems, the troubled U.S. Unix multiuser systems maker. Hoffman contends that if Acer substitutes workstations for Altos's current product line, it could use the company's existing distribution channels, support staff, and customer base as a launching point into the Unix workstation market. When Acer bought Altos, he says, "basically it bought a channel."

CCL's Yeh agrees there is still time for Acer to make an impact in the workstation market. But for now, he picks Tatung as the Taiwanese workstation clone maker with the best chance for success because of its sheer size and apparent willingness to invest heavily to establish a foothold in the market. Yeh also believes that Twinhead has a strong engineering team with expertise in software and chip design.

But until they actually begin building and selling large numbers of workstations, it remains to be seen how serious Taiwanese companies are about competing in the workstation market. For all of them, workstations are still far from becoming major money makers. The test of their commitment will come the next time Sun cuts its prices.

Wu concedes that Sampo is being cautious about its own spending on workstations. "This is still a young market, and it will take more time to develop. But if it progresses like the PC market, then we have to be a player as early as possible." □

Workstations take on the commercial marketplace

Vendors are pushing commercial systems applications to sustain the momentum built up by technical users. There's plenty of room for growth

BY DAVE WEBB

Faced with flattening demand for technical applications, it was just a matter of time before the giants of the workstation market would zero in on the potentially huge commercial systems market.

That time has come. With unit sales to commercial users pegged to grow some 60% by 1994, Sun Microsystems Inc., Hewlett-Packard Co., IBM, and Digital Equipment Corp. have all mapped out battle plans for carving up the market.

Sun already claims a bevy of early-adopter commercial customers, including the New York Stock Exchange, Citibank Corp., Shell Oil Co., AT&T, Northwest Airlines, and Shearson Lehman Hutton Co. HP recently landed impressive sales to Wal-Mart Stores Inc. and U.S. West Inc. for commercial workstations, and nearly every major U.S. computer vendor has commercial image-processing system marketing plans that involve workstations as key components.

Sales are being propelled by the demand for relatively inexpensive, powerful, small-footprint "open" systems. The workstations' price/performance curves have reached the point at which they can compete in the commercial market: Workstations can now be had for as little as $5,000 and solution packages are less than $15,000—much cheaper than minis, which start at $18,000 and climb to $150,000.

"Workstations are now more than just an engineering tool," says Mark Tolliver, marketing manager for Hewlett-Packard's workstation group in Sunnyvale, Calif. And analyst Vicki Brown at International Data Corp. in Framingham, Mass., gushes, "Workstation memory, performance, power—all that stuff—is going up, up, up. People are thinking, 'Should I bring my mainframe or mini down to a distributed desktop?' And it's not just engineering people anymore."

The impact is being felt most in the minicomputer segment, where workstation vendors have long since seized a major share of the technical market. DEC, Data General Corp., Prime Computer Inc., and Wang Laboratories Inc. have all seen eroding mini sales and are now pushing their nonproprietary open-architecture workstations to head off further erosion in market share and revenue.

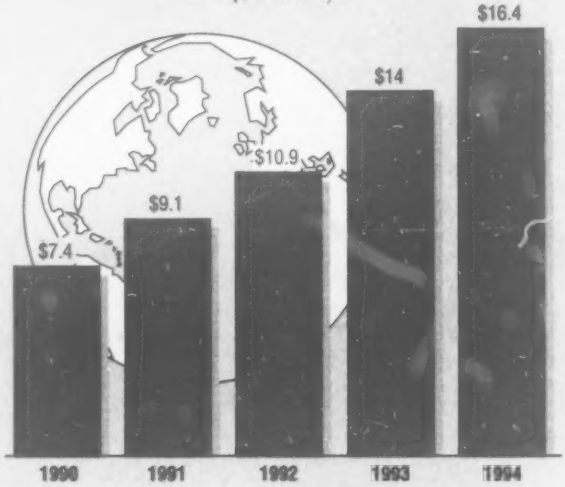
The emergence of the workstation as a business machine also could hurt PC suppliers. While vendors of desktop systems based on CISC—the hazy distinguishing characteristic between a high-end PC and a RISC workstation—migrate to faster, more powerful computers, those machines still lack the graphics and multiprocessing capabilities that workstations offer at marginally higher prices.

Distributed, so-called client/server PC architectures would be the heaviest area of competition. But some industry observers question the degree to which workstations and PCs will compete for commercial applications. Lorie Strong, vice president of marketing at Compaq Computer Corp. in Houston, is only slightly concerned about the encroachment of workstations on the commercial market. For their part, workstation vendors play down the PC's productivity advantages, which are bolstered by dozens of popular, widely available software packages. At Mips Computer Systems Inc. in Sunnyvale, marketing vice president Joseph DiNucci regards PC applications as incidental add-ons to larger, enterprisewide applications. "We'd love to have Lotus [1-2-3] and WordPerfect on our platform, but we don't need to sit in their lobbies with hat in hand to listen to what they want," he says.

One thing everyone

Continued growth for workstations

Estimates for worldwide workstation revenue ($ billions)



Source: International Data Corp.

agrees on: The $7.4 billion workstation market will continue to flatten if vendors stick to conventional technical applications. Sales pegged exclusively to technical users have recently grown by less than 20% a year, according to Gary Little, Sun's manager of industry marketing in Mountain View, Calif. By breaking into the commercial market, suppliers hope to return to the blistering growth rates once posted in the technical arena. "Workstation vendors can't keep growing as fast as they've been growing without opening up this kind of market," says IDC's Brown.

If the breakthrough in commercial applications occurs, sales could rocket: Dataquest in San Jose figures that by 1995, workstation vendors will be raking in $23 billion in worldwide revenue, mostly from the commercial market. Sun, for example, wants to boost its workstation growth rate to 40% a year, says Little. The company predicts that by 1993, its business will be divided evenly between technical and commercial systems products.

Sun has made the most noise about targeting the commercial marketplace, but most workstation vendors have charted some sort of commercial systems strategy. Most of Sun's Sparc architecture system manufacturers are also scoping out the commercial arena.

IBM's RS-6000 is gaining recognition as a commercial (versus purely technical) machine, for example, and a slew of Mips-design OEMs—Bull S.A., Prime, Wang, DEC, and Control Data, to name the larger ones—have made their intentions clear about marketing workstations in nontechnical applications. Next Inc. in Palo Alto, which revamped its product offering last year, is one of the few companies targeting commercial applications exclusively and should become a powerhouse player with its user-friendly applications. "In any emerging market there's always room for one newcomer to compete with the big guys," says Brown. "Next seems likely to be that player."

But it isn't yet clear which company is best positioned to tackle the big commercial workstation market shares. IDC's Brown thinks the four heavyweights that now dominate the technical market—IBM, Sun, HP, and DEC—will also dominate the

By 1993, Sun Microsystems aims to divide its workstation sales evenly between technical and commercial users, says Sun's Gary Little

commercial side. "I'd say IBM will take the lead, followed by HP and Sun. DEC is still a big question mark," she says.

Of all of the workstation vendors, IBM is clearly the best-entrenched company for the nontechnical market, with inroads to virtually every vertical market and an unmatched sales and distribution network. But many observers think IBM isn't

Hewlett-Packard, IBM, and Sun now seem best positioned to take the lead in commercial markets

likely to aggressively market its RS-6000 workstation, since it already has undermined sales of IBM's AS/400 mini and even threatens to erode Big Blue's lucrative mainframe business.

Nevertheless, IBM doesn't regard the RS-6000 as a liability to larger systems sales. Chris Walter, IBM's director of advanced workstations marketing in White Plains, N.Y., argues that many factors go into customers' buying decisions—including the decision to go with either distributed computers or mainframes. "The RS-6000 just adds to the range of products we offer," she says.

Sun, meanwhile, suffers from the lack of an entrenched commercial distribution network but is working hard to establish commercial channels. HP is considered second to IBM in terms of established commercial channels and will be a strong contender. DEC, the fourth technical-workstation market heavyweight, still seems stalled in its efforts to market commercial workstations.

Scarce software

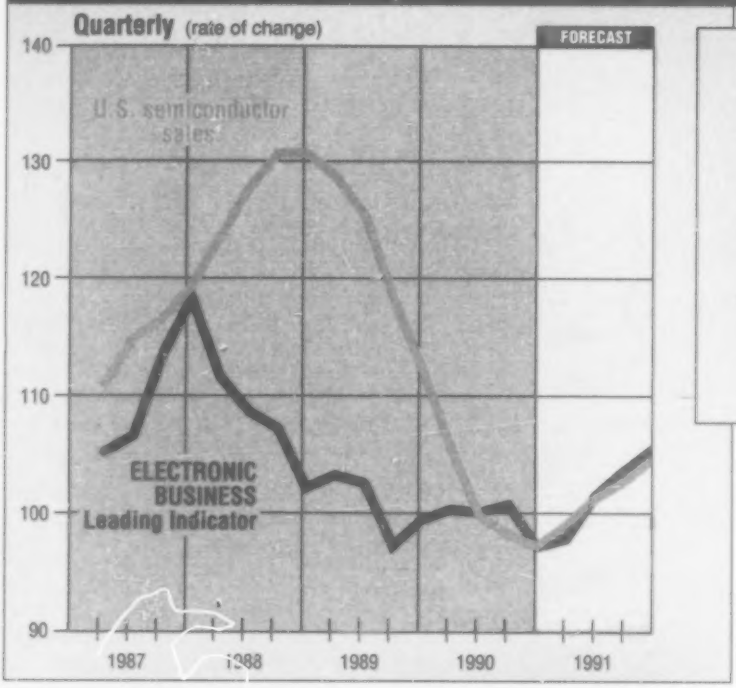
Few other workstation vendors to date have sold large numbers of products into the commercial market, largely because the available applications software is relatively scarce and highly customized. Some vendors, such as Silicon Graphics Corp., are sticking to technical applications, with little apparent interest in the commercial sector. In any event, the commercial market is so large that very few broad-based standardized software packages will likely emerge within the next few years. "There's a lot of internal software development going on for these applications," says HP's Tolliver, "but eventually we expect to see some broadly based software packages."

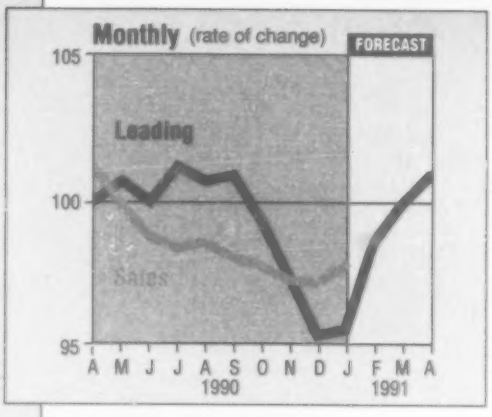
In the meantime, he says, the trick for workstation vendors will be to package software and hardware as a solution, making it easier for software developers to create custom applications. Vendors say that independent software suppliers are trying to address the shortage of application software; for now, large customer accounts are taking it upon themselves to develop applications that enable them to use workstations. In most cases, they say, the final package is still cost-effective when compared with mini alternatives.

No one is sure just how fast the commercial workstation market will grow. But Sun's Little expects the commercial market for Unix-based systems (which includes both workstations and minis) to grow larger than the technical market by 1994. Little estimates the 1989 technical market at $6.5 billion, versus $5 billion for commercial applications. By 1994, he says, Sun expects the technical side of Unix to grow to $19 billion and the commercial side to $23 billion.

If he's right, it seems that there is plenty of room for growth for all the major players, and many of the minor ones as well. □

ELECTRONIC BUSINESS Leading Indicator remains flat in January





Leading Indicator remains flat in January

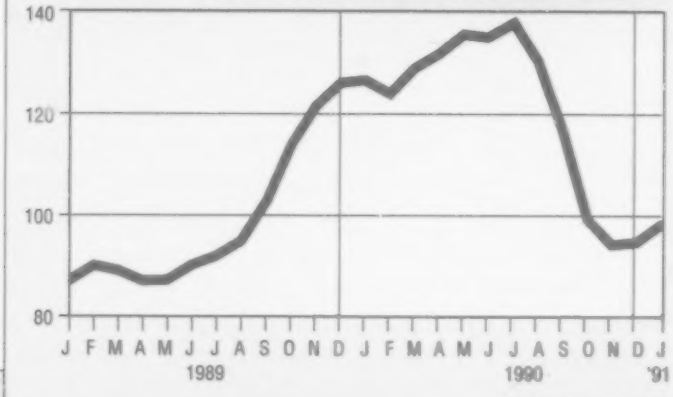
The worst may be behind us. The ELECTRONIC BUSINESS Leading Indicator appears to have bottomed out. Since the most recent peak of 101.3 in July 1990, the EBLI sank to 95.5 in December, which may prove to be the low point of the current business cycle. In January, it flattened out at 95.7, which is a positive signal.

Of the six components that make up the EBLI, three declined steadily this past autumn and contributed the most to the sagging EBLI. Stock prices had the largest swing, from a three-month rate of change of 137.6 in July 1990 to a low of 94.2 in November 1990. The next two months posted growth for stock prices—an optimistic sign for a recovering EBLI.

The ELECTRONIC BUSINESS Leading Indicator is a weighted composite of six statistics that tend to lead activity in the electronics industry. To obtain your complimentary background paper, contact Cahners Economics, 275 Washington St., Newton, MA 02158-1630, USA; telephone (617) 630-2119; fax (617) 630-2100.

Stock prices on the mend

Semiconductor composite stock price (Quarterly rate of change)



Source: Standard & Poor's

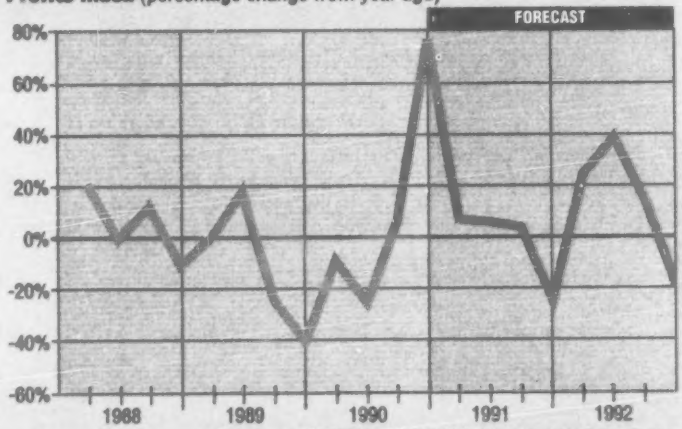
	Latest month	Previous month	Year ago	1990 average
ELECTRONIC BUSINESS Leading Indicator (rate of change, Jan.)	95.7	95.5	101.7	99.8
U.S. semiconductor bookings ($ millions, 3-month average, Jan.)	$1,107	$1,139	$1,233	$1,249
Weekly hours of semiconductor production workers (monthly average, Dec.)	41.1	40.8	41.7	40.4
Electronics components lead time index (1977 = 100, Feb.)	108.0	73.9	89.9	80.7
S&P's semiconductor stock price index (1970 =10, monthly average, Jan.)	59.6	57.4	60.5	64.6
Change in electronic components inventories ($ millions, SA, Dec.)	$30	$65	-$187	$33.9
Contracts and orders for plant and equipment ($ billions, SA, Dec.)	$44.9	$40.5	$48.9	$42.1

SA = seasonally adjusted; all other data are not seasonally adjusted

Sources: Semiconductor Industry Association, U.S. Bureau of Labor Statistics, *Electronics Purchasing*, Standard & Poor's, U.S. Department of Commerce , U.S. Bureau of Economic Analysis

Electronics profits surge in fourth quarter...

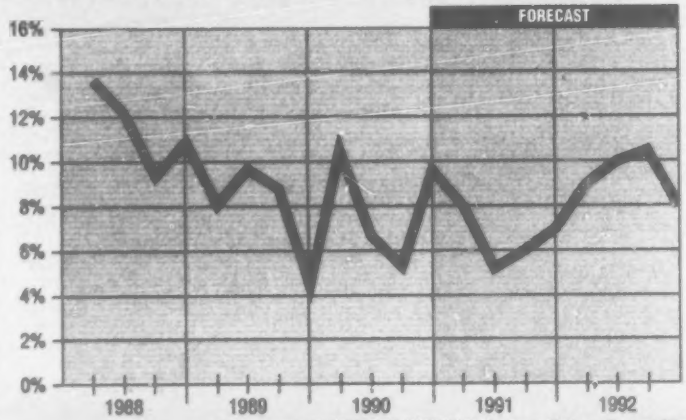
Profits index (percentage change from year ago)



Data source: ELECTRONIC BUSINESS; Forecast: Cahners Economics

...while revenues continue to build...

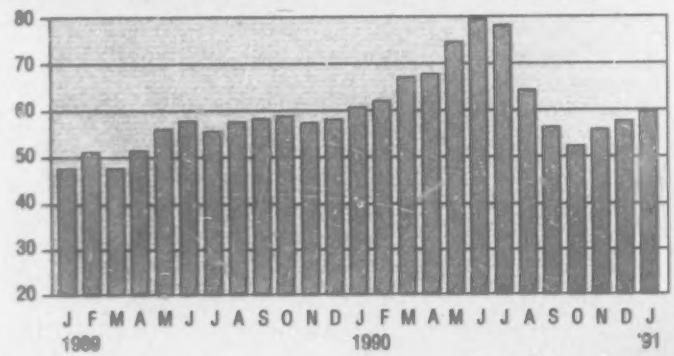
Revenue index (percentage change from year ago)



Data source: ELECTRONIC BUSINESS; Forecast: Cahners Economics

...and investors are bidding up stock prices

(S&P's component companies' stock price index, 1970=10)



Data source: Standard & Poor's

Despite gloom, profits grew in 1990

The electronics industry recorded one of its most profitable periods in the fourth quarter of 1990. According to the ELECTRONIC BUSINESS profits index—a sampling of the financial performances of 17 major electronics companies—profits surged 76.4% in the fourth quarter compared with a year earlier. Profits for the entire year rose 8.3% from 1989.

Why did electronics industry profits soar even though the economy was heading into a recession? One reason is that revenue growth remained steady in 1990. Receipts climbed 9.6% in the fourth quarter compared with a year ago and rose 8% in all four quarters of 1990 compared with 1989.

Secondly, restructuring in 1989 helped 1990 earnings. The electronics industry has been experiencing relatively slow growth since 1988; in response, many electronics companies restructured. These one-time charges were partly responsible for a 13.8% profits decline in 1989, but they also meant that the 1990 bottom line was bound to improve, recession or no recession.

Thirdly, a falling U.S. dollar boosted the bottom line of most of these U.S.-owned companies. According to Cahners's electronics trade-weighted dollar index, the dollar reached a new low in October 1990. That made U.S. electronics products less expensive abroad, and foreign sales expanded in response. Furthermore, those U.S. companies who have a high share of foreign sales saw their balance sheets improve as foreign sales made in local currency were translated back into U.S. dollars.

As a result of the stronger profits, investors are once again interested in electronics companies. Standard & Poor's stock price index for semiconductor and component companies climbed from a low of 52 in October to 59.6 in January. Wall Street analysts believe that higher profits are ahead for the electronics industry. As long as domestic demand flounders, however, Cahners Economics' profit outlook remains cautious. New orders for electronics are dragging at home. Unless the domestic market recovers quickly, profits will drop 5% in 1991. In contrast, 1992 should see profits rise 13%.

JOHN FARRELL

For more information on Cahners Economics' forecasting services, including seminars, newsletters, and database diskettes, contact Dan Buchan at (617) 630-2105, by fax at (617) 630-2100, or write Cahners Economics, 275 Washington St., Newton, MA 02158